A PLANT ECOLOGICAL SURVEY OF THE NOORSVELD†

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ABSTRACT

The vegetation of the Noorsveld, which is considered to be unique due to the abundance of a succulent spiny, leafless bush, *Euphorbia coerulescens* is described. The area is situated in the 250 mm rainfall area of the Eastern Cape. The soil is generally shallow and fine, and is mainly derived from shales.

Four vegetational strata are distinguished in the Noorsveld. The vegetation was divided into the following 8 communities, according to the abundance values of the major species, which were ranked into a descending order based on their height and aerial cover.

1. *Pappea capensis* Community
2. *Portulacaria afra* Community
3. Tall Mixed Shrub Community
4. *Aloe ferox* Community
5. *Rhigozum obovatum* Community
6. *Euphorbia coerulescens* Community
7. *Pentzia incana* Community
8. *Acacia karoo* Community

The distribution patterns in the Noorsveld of each of the major species, defining a community, are given, as well as a Vegetation Map of the Noorsveld. The structure of each community is briefly discussed.

The relationships of the vegetation in the Noorsveld are considered and special attention is paid to the effects of man and the grazing animal on the developmental process.

INTRODUCTION

The Noorsveld, as an unique tract of vegetation, has interested botanists and agriculturalists for many years. Despite this interest none or little information regarding the Noorsveld has been forthcoming. The object of this paper is therefore to present a detailed account of this relatively unknown vegetation. The basic vegetational units are given, as well as their distribution, structure and development. On account of the continued and accelerated exploitation of the Noorsveld through farming practices, it is hoped that this study will serve as foundation for further ecological work and to further the aims of veld conservation which was laid down by the Soil Conservation Act of 1946.

The Noorsveld, lying approximately between longitudes 24° 30′ E and 25° 25′ E and latitudes 32° 44′ S and 33° 15′ S, is essentially a farming area of about 855 square miles. It is the centre of the Angora goat industry and includes portions of the magisterial districts of Jansenville and Somerset East.

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"Noors," the common name of *Euphorbia coerulescens*, is used by Acocks (1953) to typify the Veld Type. According to the Veld Types Map of South Africa (Acocks, 1953) the Noorsveld covers an area of approximately 1,200 square miles (Roux, 1953). The boundary of the Noorsveld, as set out by Acocks, does not correspond with the boundary presented in this account. Acocks connects outliers and isolated small patches of the *E. coerulescens* population with the main body of the Noorsveld; in this study only the main body of the population is considered. Acocks delimites also areas where *E. coerulescens* occurs together with *Portulacaria afra* as "Succulent Mountain Scrub" (Veld Type No. 25), while in this account these areas are included as Noorsveld.

The origin of the name "noors" is unknown. However, it is possible that it has been derived from the Afrikaans word "nors" or "noors," which means unfriendly or grumpy—such as the *E. coerulescens* veld appears to be.

TOPOGRAPHY, GEOLOGY AND SOILS

Topographically the Noorsveld presents a rather undulating landscape. Fig. 1 shows that the outstanding feature of the region is a large plain, bounded

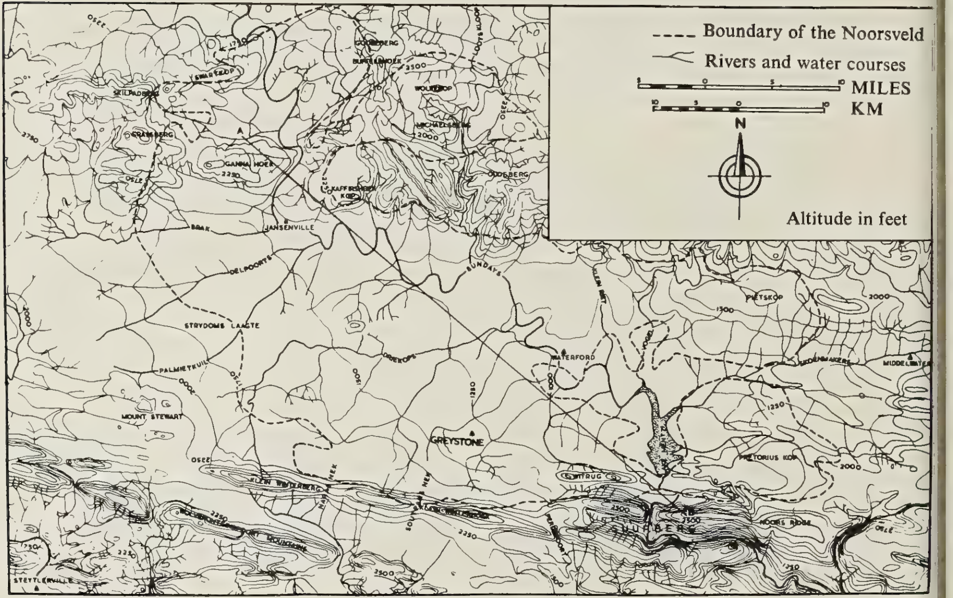


FIG. 1. Topographical Map of the Noorsveld.

in the south by the Klein Winterberg, Klein Winterhoek and the Suurberg Mountains. The undulating, almost monotonous plain, extends in a east-west direction and supports the main area of the Noorsveld. The plain itself extends approximately 16 miles (26 km) in a north-south direction and 47 miles (76 km) in an east-west direction, and has a mean altitude of 1,500 ft. An extensive basin 150 square miles and with a mean altitude of 950 ft (289 m), forms a large part of the plain. Lake Mentz occupies 8 square miles of the basin. In the north-eastern portion of the Noorsveld, the topography is varied and characterized by rounded hills. Between these hills are numerous valleys, with the main valley deeply incised by the Sundays River.

The geological formations represented in the area are strongly folded, and belong to the Cape System as well as to the Karoo System. The Cape System is represented by the Witteberg Series, and the Karoo System by the Dwyka, Ecca and Beaufort Series, which show occasional intrusive dolerite dykes.

The soils of the Noorsveld are classified as Semi-arid and Desert Types by Van der Merwe (1962). Lithosols are found almost throughout the Noorsveld on the plains, ridges and mountains, and are mainly composed of almost uniformly disintegrated shales, sandstones and mudstones, giving rise to the thin veneer of soils overlying the bedrock. The surface soils have mainly a varying mixture of dark-brown, sandy loam and a dark-brown, sandy-clay-loam layer. The soil pH varies from slightly acid to slightly alkaline. The depth of the soil varies from a few inches to 2 ft (0·6 m), and the ground surface is almost throughout strewn with stone fragments or rubble. Recent alluvial soils, deposited by water, are found in narrow strips along water courses and occur extensively around Lake Mentz. These soils are of great agricultural importance to this area.

The Noorsveld is drained in the form of a dendritic pattern, as is shown by the Sundays River system. On the whole, the drainage of the Noorsveld is well developed.

CLIMATE

According to Köppen's classification of world climate (Schulze, 1947) as well as the formulae proposed by Miller (1950), the Noorsveld has a desert climate, which is hot and dry.

The mean daily sunshine duration at Jansenville 1,450 ft (442 m) for the period 1956–1963, varied from 6·9 hours during the day late autumn month, May, to 10 hours during the wet early summer month, December, which indicates the arid character of the region.

Temperature records for Jansenville 1,450 ft (442 m) and Lake Mentz 994 ft (303 m), shows that there is a relatively small seasonal difference in mean temperatures. It also indicates that the values for absolute maximum are higher on the plains than on the northerly ridge areas, but that the values for mean daily maximum and mean daily minimum almost correspond. The average temperature for Jansenville for the period 1940–1950 at 1400 hours was 25°C (77°F).

Observations on wind direction and wind speed at Jansenville, indicates that the south-easter comprises 60% of the total winds. This is contrary to that of the neighbouring Karoo areas where the predominant wind is from the west. October to March is the windy period, when the south-easter often reaches speeds of 8 m/sec., and the frequency of calms falls below 30%.

The Noorsveld lies in the summer rainfall area of South Africa. The average rainfall per annum for the whole of the Noorsveld during the period 1878–1950 was 256 mm. The peak rainfall month for the whole area is March, while June is generally the driest month. The south-easterly wind is the main rain bearing wind. The rain falling in the Noorsveld is usually of orographical and convectional origin, with the latter being more common during spring and summer. The rains are usually of low intensity. That the rainfall of this region is markedly effected by the mountain ranges in the south and north is shown by the rain-shadow which is created north of the Oudeberg Mountains. Droughts do not occur in any regular pattern, and are generally of low intensity owing to the usually short duration of each. As an ecological factor hail seems to be of some importance in the Noorsveld. Due to its general low altitude, the area is relatively frost-free. Winter fog occurs only during the early mornings in the plains and in the valleys.

Main Ecological Regions

During the survey four main ecological regions were recognized in the Noorsveld according to topographical differences, namely river banks, plains, ridges and mountain slopes. Fig. 2 depicts an idealized section (A to B; Fig. 1) in profile through the Noorsveld, which shows the occurrence of the main plant communities as related to the ecological regions. The communities shown in the foreground for each ecological region, are those which are mainly present in the respective areas. Towards the background in the figure, the variation in the communities is depicted.

Methods

The method adopted to make a complete systematic record of the distribution of major plant species over the whole area, was to make observations on abundance at specific survey sites on predetermined routes. Scales of visual estimation were also applied at each survey site to criteria such as height of the dominant components of the various strata, ultilization of the vegetation, ground surface condition, and the amount of stone rubble on the ground surface. The geographical boundary of the Noorsveld was also dilimited during this survey.

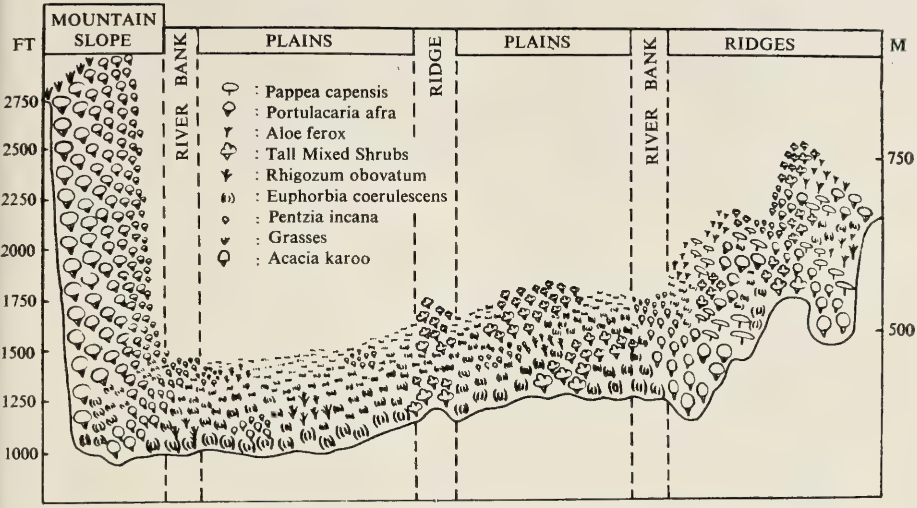


FIG. 2. An idealized profile through the Noorsveld (A to B; Fig. 1) depicting the occurrence of the main plant communities as related to the main ecological regions.

The method used for community classification was to rank the major species, chosen to define a particular community, into a descending order based on their height and aerial cover.

The determination of the structure of the major plant communities involved the collection of quantitative data. Only one survey site was chosen for each community. Owing to the lack of suitable surveying methods applicable to the Noorsveld vegetation, which is difficult to penetrate owing to the height and thorniness of the vegetation, it was necessary to resort to the chain surveying-method (Tidmarsh and Havanga, 1955), which was devised for the measurement of semi-open grasslands and karoo vegetation on rock strewn slopes.

VEGETATION

The general appearance of the vegetation is dry and xerophilous, which is evidenced by the abundance of the succulent spiny, leafless bush (Brown, Hutchinson, Prain, 1925), *Euphorbia coerulescens* (see Photo 1).

Four vegetational strata can be distinguished in the Noorsveld, viz.

A-stratum: The height of the following dominants, mainly small trees, varies between 8 ft and 13 ft (2·5 to 4 m): *Aloe ferox*, *Capparis oleoides*, *Pappea capensis*, and *Schotia speciosa*.

B-stratum: The height of the following dominants, mainly tall shrubs, varies between 4 ft and 8 ft (1·2 and 2·5 m): *Grewia robusta*, *Maytenus capitatus*, *M. polyacanthus*, *Lycium austrinum*, *Nymania capensis* and *Portulacaria afra*.

C-stratum: The height of the following dominants varies between 1 ft and 5 ft (0·3 to 1·5 m): *Euphorbia coerulescens* and *Rhigozum obovatum*.

D-stratum: The height of the following dominants, dwarf shrubs and small grasses, varies between 0·5 ft and 2 ft (0·1 to 0·6 m): *Pentzia incana*, *Aristida congesta* and *A. diffusa*.

Plants less than 0·5 ft (0·1 m) high were omitted.

The vegetation of the Noorsveld could be grouped into the following 8 communities:

1. *Pappea capensis* Community

As shown in Fig. 3, *Pappea capensis* occurs over almost the entire range of the Noorsveld. The present population, which probably represents only a small fraction of the once existing population, exhibits a continuous gradation toward greater abundance with an increase in altitude from the lower plains to the lower mountain slopes. The areas of greatest abundance are situated

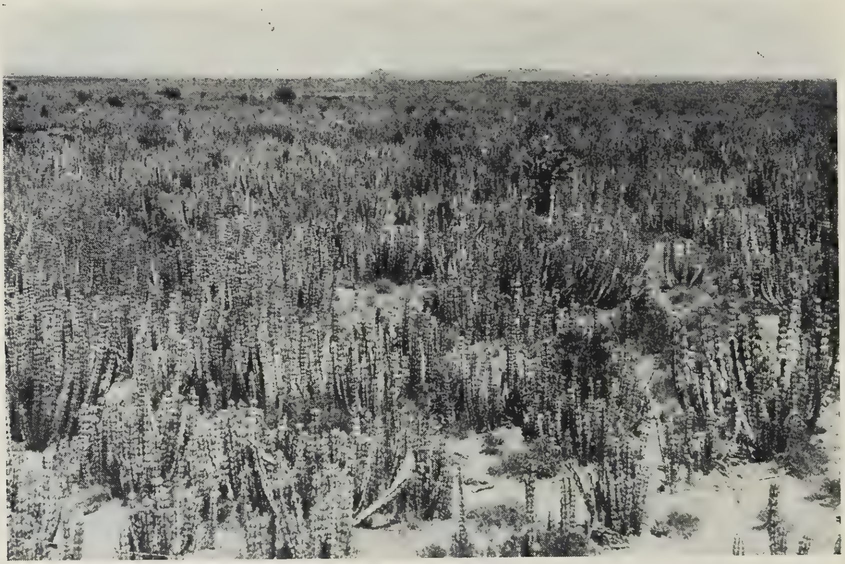


Photo 1. A dense stand of *Euphorbia coerulescens* on the lower plains.

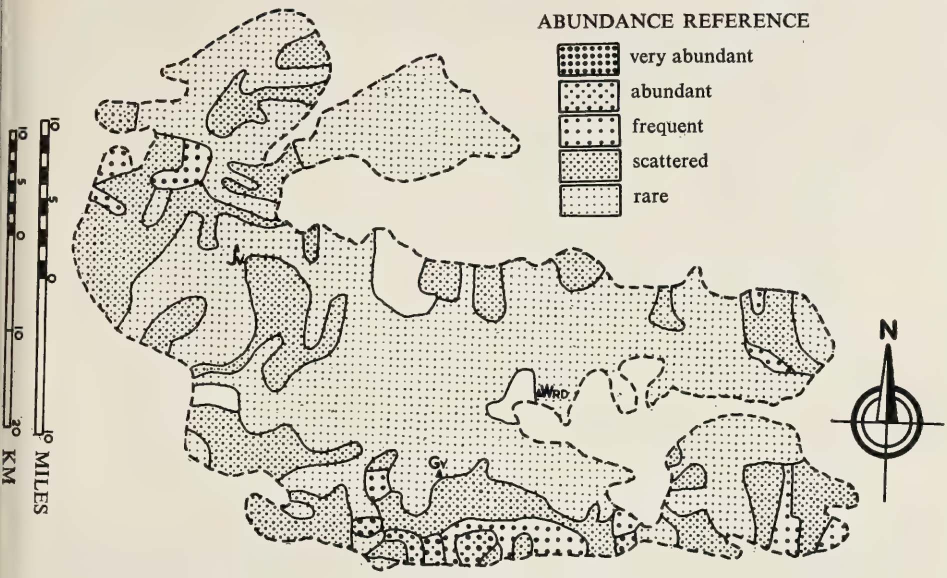


FIG. 3. Abundance of *Pappea capensis* in the Noorsveld.

along the southern boundary of the Noorsveld. From these areas northwards the population decreases gradually into the neighbouring plains.

As shown in Fig. 10, the community is found as isolated patches of limited extent on mountain slopes and ridges. The community is limited mainly to the higher southern and northern areas, where it is most characteristically developed. (See Photo 2). The community extends at its western limits on to isolated ridges, where, however, it is poorly developed.

The community is stratified into four strata. *Pappea capensis* is the dominant species in the upper stratum, and shows an uniformity in height, rarely exceeding 10 ft (3 m). The strata of tall shrubs is less definite, with *Euphorbia coerulescens* more prominent in the form of dense clusters in the C-stratum. The clusters vary in size from 2 ft to 20 ft (0·6 to 6·1 m), and have a rounded to elongated outline as would be viewed from above with no obvious regularity in form. The D-stratum is discontinuous, with patches of bare ground of more than 1 ft (0·3 m) frequent. Grasses such as *Panicum maximum* and *Sprobolus fimbriatus* are present within the *E. coerulescens* clusters. Tufted grasses mostly *Aristida congesta*, *A. diffusa* and *Eragrostis lehmanniana*, with *Pentzia incana* the more abundant among the dwarf shrubs, were frequently present between the *E. coeruslescens* clusters.

2. *Portulacaria afra Community*

The isolated patches, shown in Fig. 4, of semi-closed to closed thickets on the northern, western and eastern ridge areas and on the north-western plains, are only a remote indication of the formerly widespread population of *Portulacaria afra* in the Noorsveld.

This community occupies only a small fraction of the total area of the Noorsveld, and is represented mainly on the mountain slopes along the northern and southern boundaries of the Noorsveld, as well as on the north-western plains.

The community itself is stratified into three strata being dominated by the B-stratum with *Portulacaria afra* as the main component. The growth form of *P. afra* is slender and erect, with flexible drooping branches. The plant occurs in clumps, which vary in height from 7·5 ft (2·3 m) in the centre portion, to 1·5 ft (0·4 m) along the periphery; this difference in height is mainly ascribed to pruning by goats. The areas between the clumps are generally much less than the size of a clump, which ranged from 6 ft to 30 ft (1·9 to 9·1 m).

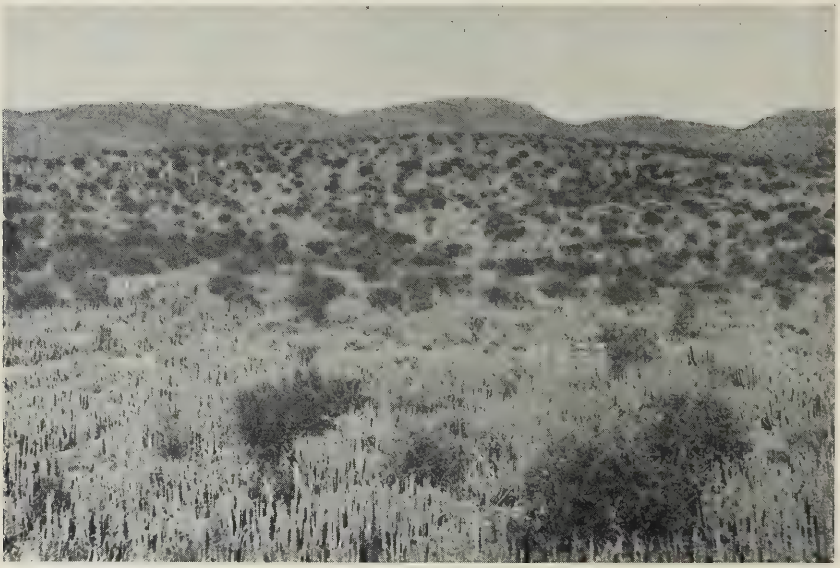


PHOTO 2. A stand of the *Pappea capensis* Community in the background on the higher northern ridges.

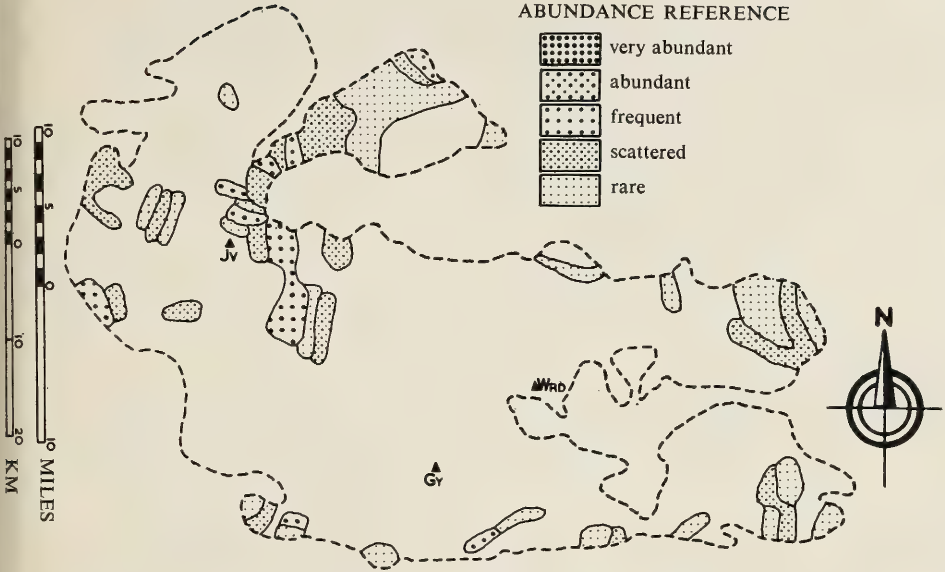


FIG. 4. Abundance of *Portulacaria afra* in the Noorsveld.

The components of the C-stratum are mainly confined to the dense *P. afra* clumps, where they are largely obscured. The height of *Euphorbia coerulescens* varies markedly, averaging 3 ft (0·9 m), but within *P. afra* clumps individual branches may reach as much as 7 ft (2·2 m). Within *P. afra* clumps, the branches of *E. coerulescens* are spread out separately, but when they occur outside these sheltered places, the branches are arranged in clusters and are dominant over small areas where the B-stratum is broken. The D-stratum is ill defined by a few dwarf shrubs mainly *Pentzia incana* and shade loving grasses such as *Panicum maximum* and *P. deustum.*

3. *Tall Mixed Shrub Community*

The following tall shrubs, which vary in height from 5 ft to 8 ft. (1·6 to 2·5 m), form the main components of this community in the Noorsveld:

Maytenus capitatus	Maytenus polyacanthus
Lycium austrinum	Nymania capensis
Grewia robusta	Carissa haematocarpa

Euclea undulata

The distribution pattern of the shrubs is related to relief features because rocky ridges seem congenial to the establishment of these shrubs. On the low lying plains in the Noorsveld these shrubs are sparsely scattered, as shown in Fig. 5.

This community is well represented over the Noorsveld, and is also most frequently found on the northern ridges.

The community is stratified into three strata with the B-stratum well represented by tall shrubs. There is a tendency for the shrubs in the *Euphorbia coerulescens* clusters to be taller than those outside. The C-stratum is very distinct in this community and is represented by *E. coerulescens* and *Rhigozum obovatum.* The former species predominates, with the clusters varying in size from 2 ft to 16 ft (0·7 to 4·8 m). The D-Stratum is represented mainly by *Pentzia incana*, *Nestlera humilis*, and *Selago triquetra* between the *E. coerulescens* clusters, but *Panicum maximum*, *Cenchrus ciliaris* and *Digitaria argyrograpta* are found sporadically within the *E. coerulescens* clusters.

4. *Aloe ferox Community*

Aloe ferox is represented only along the northern rocky ridges, generally with low abundance, although on small areas very dense stands may be found, as shown in Fig. 6.

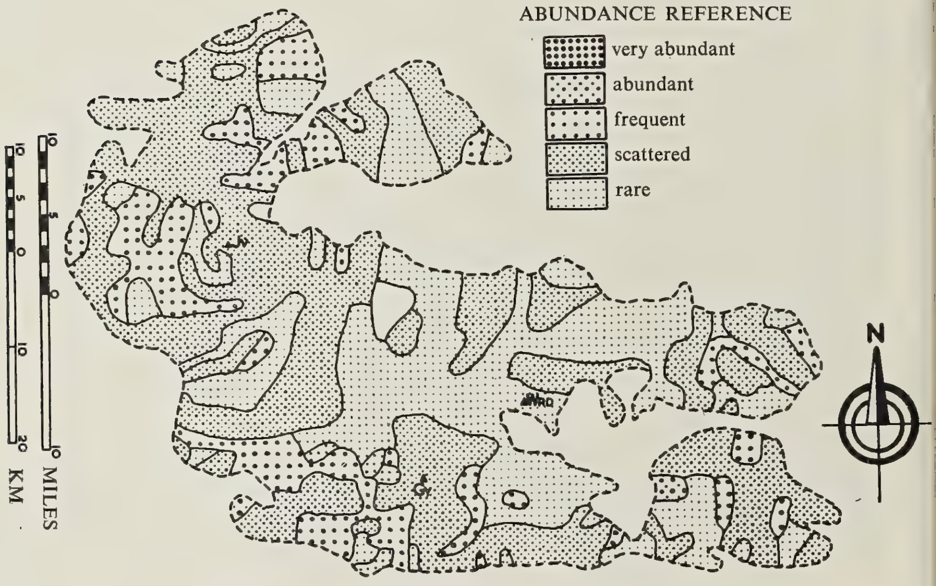


FIG. 5. Abundance of Tall Mixed Shrubs in the Noorsveld.

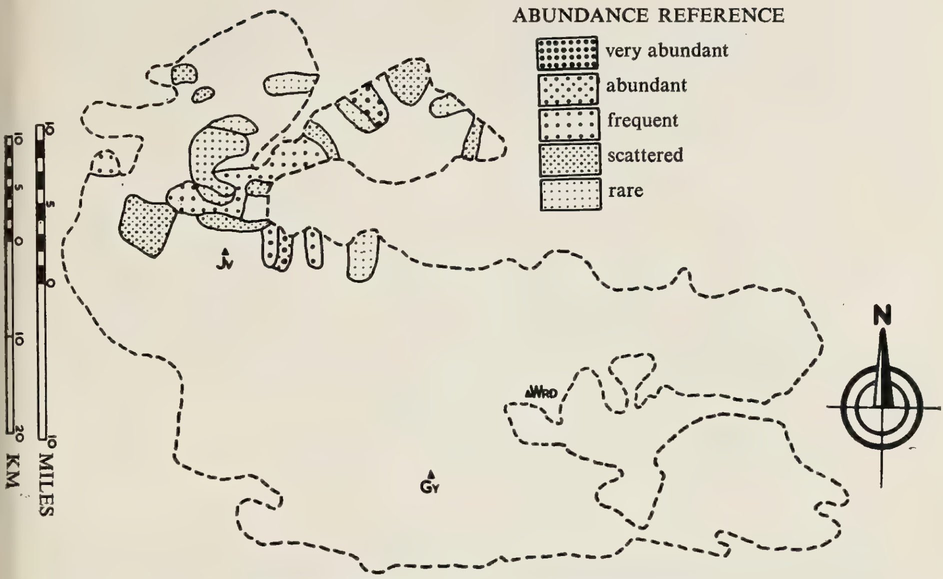


FIG. 6. Abundance of *Aloe ferox* in the Noorsveld.

The community is present in a few isolated patches of limited extent, confined to northern rocky ridges and dolerite dykes.

The community is stratified into four strata with the general structure that of relatively open upper strata dominated by *A. ferox*, with a dense D-stratum, represented by *Pentzia incana*, *Aristida diffusa* and *Eragrostis obtusa*, between the *Euphorbia coerulescens* clusters (see Photo 3).

5. *Rhigozum obovatum Community*

Rhigozum obovatum is distributed almost over the entire Noorsveld, as shown in Fig. 7. The areas of high abundance occur on the plains, with the highest abundance being reached on an area south-west of Lake Mentz.

This community is not very common in the Noorsveld and becomes generally most characteristically developed on plain areas.

Small trees and tall shrubs are absent in this community which is therefore only stratified into two strata. The general structure differs not much from that of the *Euphorbia coerulescens* Community but on the whole it is more open, with only a small number of species present.

The two major components of the C-stratum, *R. obovatum* and *E. coerulescens*, almost shares dominance, with *R. obovatum*, reaching 3 ft (0·9 m) in height, being the more prominent. The D-stratum is mainly represented by scattered shrubby members of *Lycium sp.* and *Pentzia incana*. Wide stretches of bare soil are present.

6. *Euphorbia coerulescens Community*

The main body of the *Euphorbia coerulescens* population occupies the large low lying plains between the Oudeberg Mountains in the north and the Klein Winterberg, Klein Winterhoek and Suurberg Mountains in the south, extending in a tongue into the higher northern undulating country, as shown in Fig. 8. The distribution centre is situated almost on the southern boundary, near the junction of the Klein Winterberg and Klein Winterhoek mountain ranges. From this point the abundance of the population declines sharply in a most complex, discontinuous pattern, with no evident regularity.

The irregular distribution pattern of *E. coerulescens*, with a general increase in abundance towards the centre of the Noorsveld, and the detached relict

PHOTO 3. A stand of the *Aloe ferox* Community on the north-western ridges.

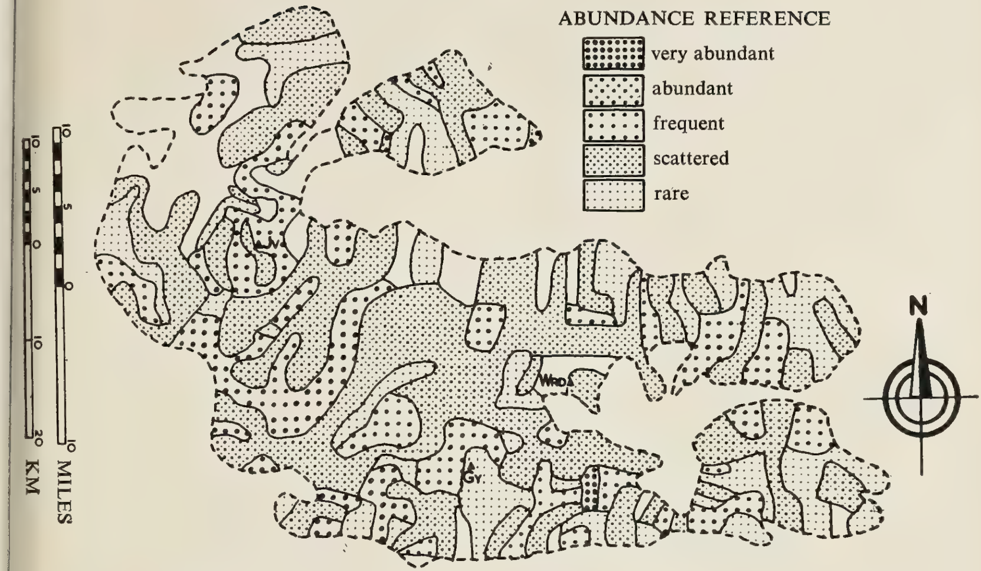


FIG. 7. Abundance of *Rhigozum obovatum* in the Noorsveld.

colonies of *E. coerulescens* in the neighbourhood of the northern, eastern and southern boundaries, suggest that the Noorsveld as such could be considered as a contracting area. There is also a general failure in the reproductive capacity of *E. coerulescens*, seed germination having almost ceased probably because of the shallow, poorly developed soil cover, while vegetative reproduction is checked to a large extent by grazing. The overall decrease in abundance of *E. coerulescens* toward the eastern boundary indicates that these parts experience the greatest amount of contraction.

That topographical features influence the shape of the Noorsveld, is shown by the relatively continuous boundary along the mountain ranges in the north and south. The possibility of further extension of the Noorsveld in these directions is doubtful because it appears that these ranges act as physiographic barriers. Extension to the east and west is probably checked by a biotic barrier. Grazing and man seems to constitute mainly this biotic barrier, because any successful establishment of *E. coerulescens* outside its present distribution, is prevented.

This characteristic and distinct community, is the most widespread community in the Noorsveld. It is most characteristically developed on the lower plains (See Photo 1).

The community is stratified into the two lower strata with the C-stratum very well represented by *E. coerulescens*. The branches of *E. coerulescens* forms dense clusters of uniform height of 2·7 ft (0·8 m), giving a relatively smooth appearance to the stratum. The D-stratum is well represented by the dwarf shrub, *Pentzia incana*, which is dominant between the *E. coerulescens* clusters, interspersed with occasional tufts of the grasses *Eragrostis obtusa*, *Aristida diffusa* and *A. congesta*.

7. *Pentzia incana Community*

As shown in Fig. 9, this dwarf shrub, *Pentzia incana*, reaches greater abundance on the lower plains than along the mountain slopes and on the higher northern ridges.

The community is found only as a few small patches which are limited to the lower plains.

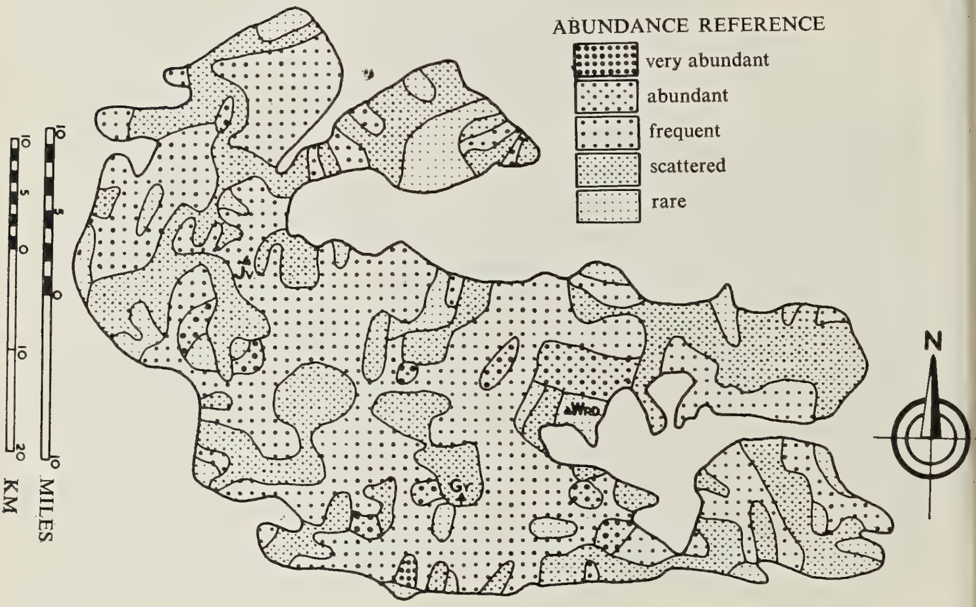


Fig. 8. Abundance of *Euphorbia coerulescens* in the Noorsveld.

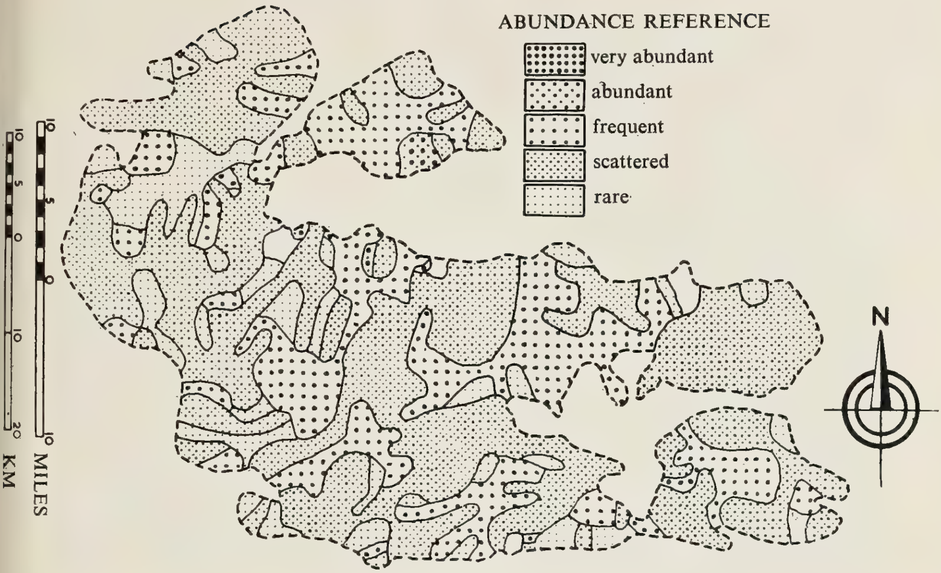


FIG. 9. Abundance of *Pentzia incana* in the Noorsveld.

Only the D-stratum is present. A few scattered branches of *Euphorbia coerulescens* are present which are too irregularly distributed to constitute a definite C-stratum. The D-stratum is dominated by *Pentzia incana*, which occurs in groups, placed at varying distances from one another. Between these groups *Aristida diffusa*, *A. congesta*, and dwarf shrubs of *Lycium sp.* attain local dominance. Large bare soil patches are present.

8. *Acacia karoo Community*

Acacia karoo is found mainly along the river courses in the Noorsveld.

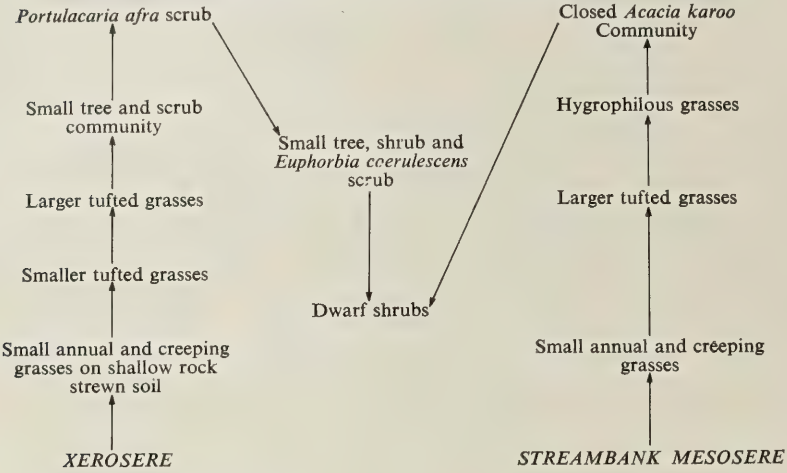
This community frequently forms a very striking contrast to the surrounding vegetation. Where fully developed the community is two-layered, with *A. karoo* very abundant, forming a closed canopy, ranging from 16 ft to 33 ft (5 to 10 m) in height. The constituents of the field layer are mainly *Panicum maximum* and *Cenchrus ciliaris*, forming local patches with bare ground between the patches.

Relationships of the vegetation

The present vegetation of the Noorsveld is of a secondary nature. Man has been directly or indirectly responsible for the change in the vegetation. Table 1 is a generalized scheme showing the relationships of the vegetation in the Noorsveld.

TABLE I

A generalized scheme showing the relationships of the vegetation in the Noorsveld.


Portulacaria afra scrub
Small tree and scrub community
Larger tufted grasses
Smaller tufted grasses
Small annual and creeping grasses on shallow rock strewn soil
XEROSERE
Small tree, shrub and *Euphorbia coerulescens* scrub
Dwarf shrubs
Closed *Acacia karoo* Community
Hygrophilous grasses
Larger tufted grasses
Small annual and creeping grasses
STREAMBANK MESOSERE

Evidence, which is largely provided by the existing vegetation, suggests that the ultimate vegetational development in the Noorsveld is a dense scrub, dominated by *Portulacaria afra*. The relict plants of *P. afra*, now protected from grazing by *Euphorbia coerulescens* clusters (see Photo 4) and which are found throughout the Noorsveld, and the isolated patches of the *P. afra* Community, indicates a former widespread occurrence of the *P. afra* scrub climax.

With the intervention of man during modern times, a rapid change of the *P. afra* scrub started. The vegetational development is deflected by grazing into a new course.

Severe grazing, checking any re-growth, results in the gradual destruction of *P. afra*. *E. coerulescens* takes advantage of the new conditions for invasion and increase rapidly in number by the centrifugal migration from rootstocks, which produces new branches that form clusters. The small trees and shrubs increase in height but not in number probably due to the elimination of competition afforded by the former well developed *P. afra* layer and with grazing checking any growth of seedlings. Grasses such as *Digitaria argyrograpta*, *Heteropogon contortus*, *Cenchrus ciliaris*, *Themeda triandra*, *Setaria neglecta* and *Panicum maximum*, which formerly formed a large component of the *P. afra*

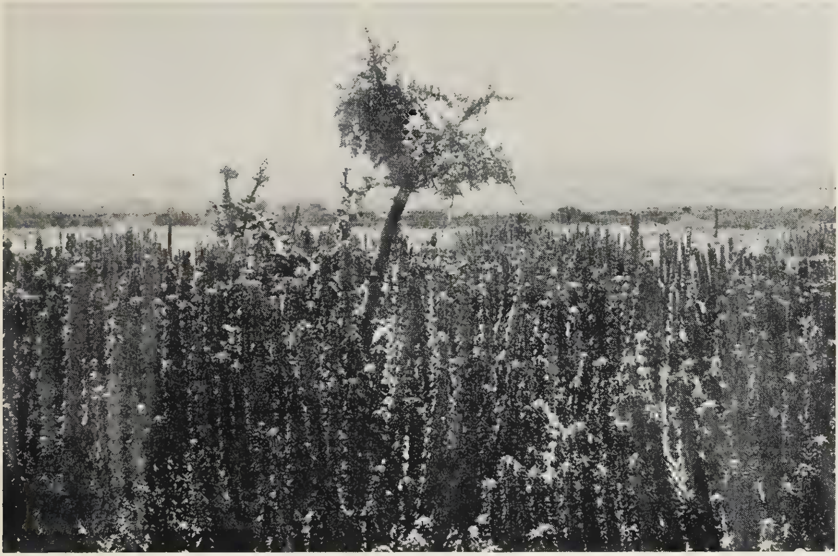


PHOTO 4. A relict plant of *Portulacaria afra* which is now protected by a *Euphorbia coerulescens* cluster.

scrub, are now protected by the *E. coerulescens* clusters. These clusters provide improved habitat conditions for the growth of these grasses because the decomposition and accumulation of dead plant parts add organic matter to the soil, thereby improving its structure.

Under continuous grazing, *P. afra* is eventually exterminated. *E. coerulescens* forms a very dense stand, which is almost impenetrable because the individual clusters link up with each other. This stage is considered to be fully developed under the action of the disturbing factors.

The further alteration of the vegetation is brought about by the combined action of man and the grazing animal. *E. coerulescens* branches are cut over large areas for fodder, thereby exposing the palatable shrubs and grasses, sheltered within the clusters, to grazing (see Photo 5). Small trees and tall shrubs, already grazed up to the browse line, are felled for fodder, firewood and fencing poles. Under these conditions soil erosion becomes accelerated. Grasses such as *Aristida diffusa*, *A. congesta* and *Cynodon incompletus*, and dwarf shrubs gradually increase. With continued grazing, species are forced out in order of their palatability.

The further development of the vegetation in this deflectional process, is largely determined by local habitat conditions.

Thus the effects of man on the vegetation of the Noorsveld, has given rise to an intricate vegetation patterning, consisting of variety of seres of deflection. The degree of deflection in the various seres, is largely related to the degree of past disturbance and not so much as to any particular environmental factor.

In conclusion, the Noorsveld vegetation can be considered to have been predominantly a *Portulacaria afra* Scrub, which has been converted into what can be described as a Small Tree, Shrub and Succulent Steppe (this terminology was taken, with modification, from Boughey, 1957).

General Aspects

The Noorsveld has a higher carrying capacity than the Veld Types adjacent to it, due to the presence of *Euphorbia coerulescens*. The presence of a large number of small farming units, some less than 400 morgen, is an indication

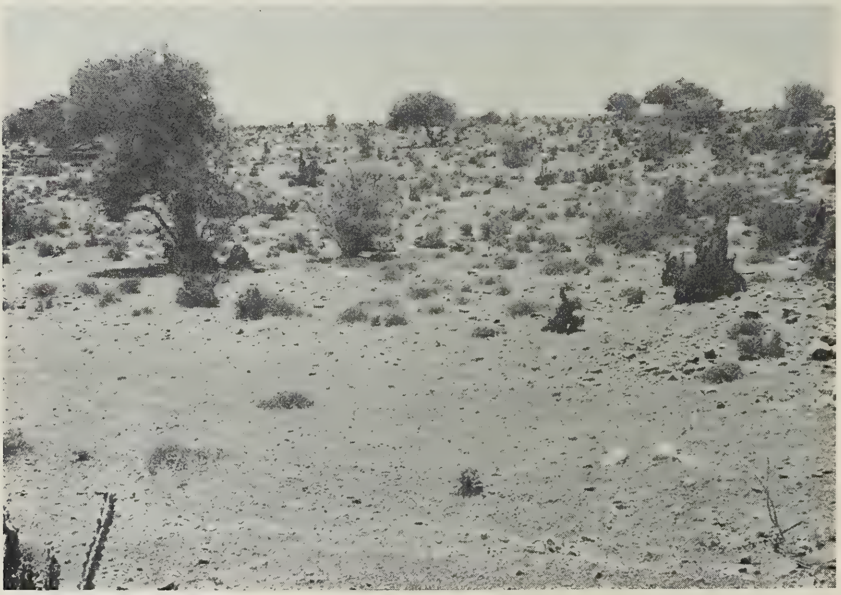


Photo 5. A severely grazed and eroded area. A few *Euphorbia coerulescens* plants are widely scattered.

of the high exploitation potential of this region. To implement higher stocking rates, some unique farming practises are being employed.

The farmers are fully aware of the value of *E. coerulescens* as fodder for stock. *E. coerulescens*, due to its drought resistant properties, also provides sufficient fodder for stock during periods of drought. The branches are not normally eaten by stock, except the soft young apical joints and shoots. Chopped up branches are, however, palatable to stock. The branches are cut into segments of 1 to 12 inches (2·5 to 30 cm) are left on the ground, or are removed to a feeding lot. The chopping of the branches is in some cases carried out by means of a machine, or by hand by means of a long-bladed panga (see Photo 6). The stock relish the chopped segments sometimes immediately, depending on the size of the chopped segments, or more often when the segments have dried out for a day or two. The stock acquire the trick of scraping off the thorns of the branches with their hooves or horns, before eating the chopped segments.

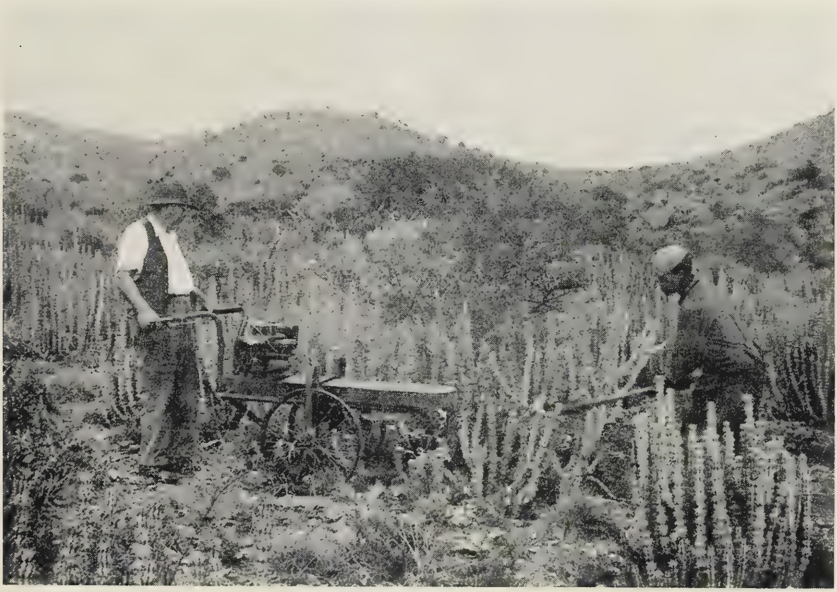


Photo 6. The two methods being used by farmers in the Noorsveld to chop *Euphorbia coerulescens* into slices.

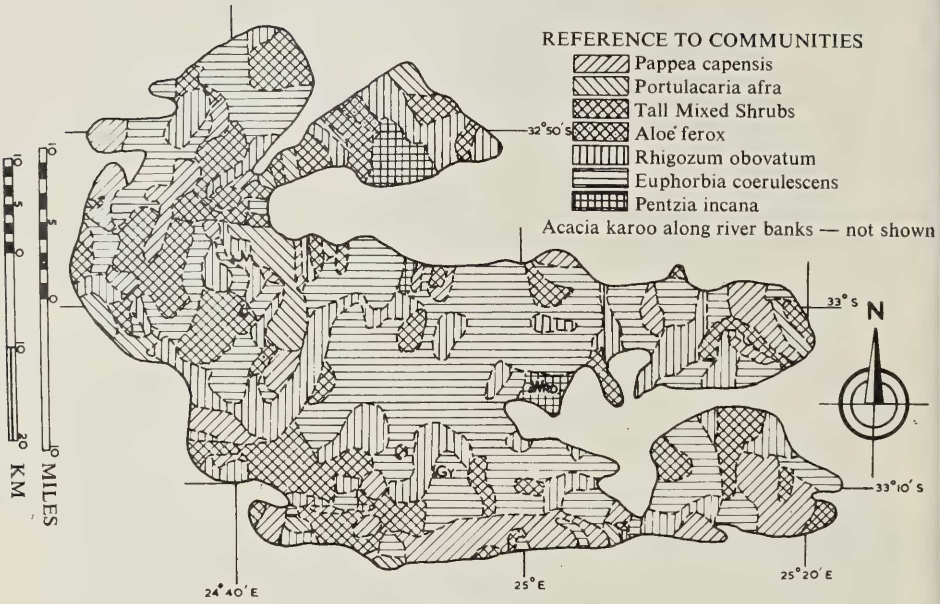


Fig. 10. Vegetation Map of the Noorsveld.

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